

## Influence of Pollen Varieties on Elemental Composition in Date Palm (*Phoenix dactylifera* L.) Cultivars (Albarben, Altabarzl, and Al-Khatibi) across Anbar Governorate, Iraq

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The study was conducted in the Republic of Iraq, Anbar Governorate, during the 2019, to find out the effect of pollen the Ghanami Ahmar (C1), Ghanamy akhdar (C2), the samesmi (C3) and the Khikri adi (C4) pollen and the concentration (Cu, Zn, K, Fe and Na) in date palm fruits of the dominant varieties; Albarben (B1), Al tabarzl (B2) and Al- Khatibi (B3). the results of the study showed that the use of different types of pollen mentioned showed statistically significant differences ( $P \leq 0.05$ ) in the concentration of some elements in the fruits of the studied date palm cultivars, as the results of the study showed a significant difference in the concentration of Cu element in the fruits of the date palm variety B2 fertilized with pollen different stallions an overlap of Cu concentration was also recorded, and there were significant differences in all the fruits of the studied date palm cultivars and pollinated with the pollen cultivars, the results of the overlap for the concentration of Zn element in the fruits of date palm cultivars inoculated with Stallion pollen C1, C2 and C3 showed that there were significant differences, as significant differences in the concentration of Zn in the fruits of date palm cultivars inoculated with the pollen of the studied stallions, The results showed that there were significant differences for the concentration of the element K in the fruits of the B2 variety and fertilized with the different pollen varieties used in the study and the overlap record for the concentration of K in the date palm fruits inoculated with pollen C1, C2 and C3 the presence of significant differences between the fruits of these cultivars, The results also showed that there were significant differences in the concentration of Fe for the fruits of palm B1, B2 and B3 inoculated with stallion pollen, and the overlap record for the concentration of Fe for the fruits of date palm cultivars inoculated with the mentioned stallion pollen significant differences, The results of the experiment showed that there were significant differences in the concentration of Na element in the fruits of date palm B2 and B3 inoculated with the pollen of the stallion, and the interaction record of the concentration of Na between the fruits of the varieties inoculated with pollen C1, C2, C3 and C4 there were significant differences, where the aim of the study was Determination of the concentration of minerals in the fruits of three cultivars of palms grown in the region.

**Keywords:** Albarben, Cultivar, Date palm, Fruit, Pollen.

### INTRODUCTION

The date palm tree (*Phoenix dactylifera* L.) belongs to the Palmaceae family, and its fruits are of high nutritional value as they are rich in basic and necessary elements for the body such as minerals, vitamins, sugars, proteins and amino acid (Aljaloud *et al.*, 2020; Hussain *et al.*, 2020). Dates are nutritious and can play a key role in human nutrition and health (Hussain *et al.*, 2020). Its noticed differences in the chemical composition of pollen grains of five male date palm cultivars (Aly, 2018), and these differences had an impact on the concentration of mineral elements in them and vitamins

(A and B), the mineral elements contribute significantly to the determination of the quantity and quality of the fruits (Dghaim *et al.*, 2021).

The quality of irrigation water, the quality of the soil, the environmental conditions and the agricultural service operations of the date palm trees have a significant role in changing the content of the fruits and leaves of the mineral elements, that concentration of some trace elements Fe, Cu and Zn in pollen grains of certain stallions leads to the superiority of pollen grains of these elements over the pollen grains of other stallions (Lateef *et al.*, 2021).

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It is noticed (Hamza and Hashimi, 2023) a high concentration of Cu and Zn in the dry weight of the fruits of some cultivars in the location near the banks of the Shatt al-Arab, compared to the remote location of the banks of the Shatt al-Arab, in which the concentration of the two components for the dry weight of the fruits was less. The results of the study also showed a monthly variation in the average concentrations of Cu and Zn and for both locations, Suwaid and Muntaha Abdel-Zahra (2011) conducted a study to estimate the mineral content of major nutrients P, Na, N, K in pollen of two agricultural types, alwardi and samesmi. The study also showed a significant superiority of samesmi pollen in the average concentration of the elements P and Na compared to the alwardi pollen, and the results did not show significant differences for the element K in the pollen of the samesmi and alwardi stallion. Assirey *et al.* (2015) conducted an experiment on ten types of date palms in Saudi Arabia to know their chemical composition. The results showed that the concentration of K is the highest, followed by Ca, Mg, P and Na in descending order. Na (sodium) was relatively low in some types of fruits (Brown, 2023); in contrast to K (Melse-Boonstra, 2020), which was high in concentration in fruits and is useful for people suffering from blood pressure, the presence of Na / K in the body is beneficial for intercellular activities and maintaining homeostasis osmosis of body fluids and protect it from excessive fluid loss. It is involved in muscle contraction and conduction of impulses along the nerve fibers (Yamada & Inaba, 2021), it has been showed that the extract of date palm fruit contains many nutritional values and beneficial elements such as Ca, K, Mg, P and Fe in different proportions, it is preferable to eat dates regularly because of its beneficial properties in increasing sexual ability and reducing infertility, fatigue and stagnation in patients with anemia because of the element Fe in addition to other elements (Al-Mssallem *et al.*, 2020). Yamada, S., & Inaba (2021) mentioned that K is the most abundant metallic element among the elements and in all studied palm fruits at varying levels, followed by Ca, Mg, S and P. The results of Yamada & Inaba (2021) also showed low levels of Fe, Na, Cu, Mn and Zn, confirmed that the chemical composition of the date palm fruits has important health benefits such as cardiovascular diseases and as a treatment for infectious disorders because it contains mineral elements.

In present study different strain/cultivars of palm date of Iraq were evaluated for concentration of Fe, K, Ca, Cl, Cu, Mg, S and P.

## MATERIALS AND METHODS

**Field experience:** The study was conducted in Anbar Governorate - Heet District (Al-Hasniya village) during the 2019 agricultural season to find out the effect of pollen varieties C1, C2, C3, C4 on the concentration of some elements in the date palm fruits of agricultural varieties B1,

B2, B3 as the fruits were collected from each cultivar and fertilized with pollen from stallions used singly in the date stage as follows;

Three fruits were taken in the tamar stage from each palm after harvesting the fruits and the seed were removed from them. It was dried by a device a Hot Air Sterilizer at a temperature of 65 °C for 72 hours in the laboratories of the College of Applied Sciences Heet / Anbar.

### *Estimate the content of the studied Elements:*

- The fruits were crushed after drying, taking 1 gm of each sample was taken using a sensitive electronic balance, and the samples were placed in 50 ml beakers.
- The samples were digested by the concentrated acid mixture HNO<sub>3</sub> + HCl, with the amount of three volumes of HCl and one volume of HNO<sub>3</sub>, i.e. 20 ml) for each sample of the two mentioned acids, and the samples were left for 10 minutes to complete the digestion complete.
- Heating was done by a device a Hot plate Stirrer at a temperature of 60 °C for a period of 30 minutes, and after the heating process was completed, they were left to cool and distilled water was added to them up to the mark of 50 ml. Then filter papers were placed in funnels fixed on a metal holder and each sample was filtered separately and kept in plastic containers of 50 ml capacity until conducting the following chemical analyzes:-
  1. The content of fruits of Zn, Cu and Fe elements was estimated in the Laboratories of the College of Applied Sciences Heet / University of Anbar using the Flame Atomic Absorption Spectrophotometer, based on the method described by Hamza & Hashimi (2023).
  2. The content of the fruits for the elements K, Na, was estimated in the Laboratories of the College of Applied Sciences Heet / Anbar and the laboratory of the Great Ramadi / Ramadi water project, using a PHOTOMETER Flame device.

**Statistical analysis:** Statistical analysis was conducted in one direction (one way analysis), and the trend included the influence of male or female varieties in the studied traits, by following the general linear model and using the ready-made SAS statistical program version 9., and significant differences between the averages were tested. Using Duncan's polynomial test at the level of significance ( $P \leq 0.05$ ).

## RESULTS AND DISCUSSION

**Copper (Cu) concentration rate in date palm fruits:** The results Table 1 showed that there were significant differences ( $P \leq 0.05$ ) for the rate Cu concentration, as the Cu concentration rate was significantly superior in the B2 palm fruits inoculated with C1 pollen and the highest value was 1.15 ppm comparison to the Cu concentration in palm fruits inoculated with C4 pollen who scored the lowest value of 0.50



ppm, the results of the mentioned table also indicated a significant superiority in the rate of Cu concentration for the to interfere between the fruits of palm cultivars B1, B2 and B3, where the highest rate of Cu concentration in the fruits of palm B3 inoculated with C1 pollen was 1.60 ppm compared to the inoculated Cu concentration the fruits pollen of cultivars B1 and B2, which recorded the lowest values of 1.20 ppm, 1.15 ppm respectively, the results showed that the highest rate value of Cu concentration in palm fruits of variety B3 inoculated with C2 pollen was 1.80 ppm compared to the rate concentration of Cu in palm fruits of variety B2 which recorded the lowest value of 0.85 ppm, the results of Table 1 indicated that the highest concentration of copper was in B3 date palm fruits inoculated with C3 pollen, which amounted to 1.55 ppm, while the lowest copper concentration was in B2 date palm fruits. 0.80 ppm, and the results showed that the highest rate of copper concentration was in the fruits of date palm B3 inoculated with C4 pollen grains, which amounted to 1.60 parts per million, while the lowest rate of copper concentration was recorded in the fruits of date palm variety B2. It reached 0.50 ppm, this is in agreement with the findings of Assirey (2015), and is inconsistent with the findings of Lateef *et al.* (2021), as this difference in response confirms the existence of an actual statistical overlap between the two study factors (agricultural cultivars and pollen quality), which created a clear difference from the effect of the factors and is single for (Al-Ebrism, 2016).

**Table 1. Effect of male and female cultivars on copper (Cu) ppm concentration in fruits.**

morale level	Male cultivars				Female cultivars
	(C4)	(C3)	(C2)	(C1)	
N.S	B	B	B	B	(B1)
	0.063±1.05	0.051±1.15	0.040±1.20	0.063±1.20	
	a	a	A	a	
0.0005	C	C	C	B	(B2)
	0.063±0.50	0.086±0.80	0.034±0.85	0.046±1.15	
	c	b	B	a	
N.S	A	A	A	A	(B3)
	0.075±1.60	0.075±1.55	0.080±1.80	0.075±1.60	
	a	a	A	a	
	0.0001	0.0010	0.0001	0.0053	morale level

● Values mean rate ± stander error.

●● N.S: It means that there are no significant differences between the rates of the transactions at the morale level ( $P \leq 0.05$ ).

●●● a, b, c: the different lowercase letters within the same row indicate the presence of significant differences between the male varieties, while the different capital letters within the same column indicate the presence of significant differences between the female varieties within the same male variety at the morale level ( $P \leq 0.05$ ).

**Zinc (Zn) concentration rate in date palm fruits:** The results of Table 2 indicate that there is a significant difference ( $P \leq 0.05$ ) in the rate Zn concentration in the fruits of date palm variety B1 inoculated with C1, C2, C3, and C4 seedlings, as the highest rate of Zn concentration was recorded in palm

fruits inoculated with C3 and C4 pollen, it reached 9.50 ppm, 8.50 ppm respectively. The lowest values of Zn concentration average were recorded in palm fruits inoculated with C1 and C2 stallions. 6.50 ppm, 6.00 ppm respectively, the results also showed that there were significant differences in the rate concentration of Zn in the fruits of date palm variety B2 inoculated with the pollen of the stallions, and the highest of the rate concentration of Zn in the fruits of the date inoculated with pollen C2 was 13.00 ppm, while the lowest rate of the concentration of Zn in the palm fruits inoculated with pollen C1 was 7.50 ppm, The results showed that the highest rate values of Zn concentration in B3 palm fruits inoculated with C1, C4 pollen were 8.50 ppm, 7.50 ppm respectively, while the lowest rate Zn concentration was recorded in palm fruits inoculated with C3 pollen, C2 reaching 6.00 ppm, 5.00 ppm respectively, the results of Table 2 indicated that there was a significant difference ( $P \leq 0.05$ ) for the rate Zn concentration of the to interfere between the fruits of the palm cultivars used in the study, as it recorded the highest value of the rate Zn concentration in the fruits of date palm variety B3 inoculated with C1 pollen grains reached 8.50 ppm compared to the lowest rate of Zn concentration in The fruits of date palm variety B1 reached 6.50 ppm, the results also showed that the highest rate concentration of Zn in fruits of cultivar B2 inoculated with C2 pollen amounted to 13.00 ppm compared to the lowest rate concentration of Zn in fruits of date palm cultivars B1 and B3 which amounted to 6.00 ppm and 5.00 ppm respectively, the results also indicated that the highest rate concentration of Zn in the fruits of date palm varieties B1 and B2 inoculated with C3 pollen was 9.50 ppm compared to the rate concentration of Zn in the fruits of date palm variety B3 which recorded the lowest value of 6.00 ppm.

**Table 2. Effect of male and female cultivars in zinc (Zn) ppm concentration of fruits**

morale level	Male cultivars				Female cultivars
	(C4)	(C3)	(C2)	(C1)	
0.0003	A	A	B	B	(B1)
	0.340±8.50	0.121±9.50	0.357±6.00	0.484±6.50	
	a	A	b	b	
0.0001	A	A	A	AB	(B2)
	0.127±8.50	0.184±9.50	0.404±13.0	0.329±7.50	
	c	B	a	d	
0.0002	A	B	B	A	(B3)
	0.375±7.50	0.305±6.00	0.213±5.00	0.340±8.50	
	a	B	b	a	
	N.S	0.0001	0.0001	0.031	morale level

Values mean rate ± stander error.

N.S. It means that there are no significant differences between the rates of the transactions at the morale level ( $P \leq 0.05$ ). a, b, c: the different lowercase letters within the same row indicate the presence of significant differences between the male varieties, while the different capital letters within the same column indicate the presence of significant differences between the female varieties within the same male variety at the morale level ( $P \leq 0.05$ ).



The results agreed with the results of Stanley and Linskens (2012), the reason for the variation Zn concentration in palm fruits of different cultivars may be due to the difference in the mineral content of pollen grains from one variety to another cultivar (Al-Samarai *et al.*, 2016).

**Potassium(K) concentration rate in date palm fruits:** The results of Table 3 showed that there were significant differences ( $P \leq 0.05$ ) in the rate amount of K in the fruits of date palm variety B2 inoculated with the pollen of the stallions used in the study the highest potassium concentration was recorded in palm fruits inoculated with C3 pollen, which amounted to 1.92%, compared with the average K concentration in palm fruits inoculated with C2, C1 and C4 pollen, which recorded the lowest values of 1.01% and 0.94. % 0.94%, respectively, the results showed that the highest rate of K concentration for interference in the fruits of date palm B3 inoculated with pollen C1 was 1.16% compared to the lowest rate of K concentration in the fruits of date palm variety B2 which amounted to 0.94%, the results also showed that the highest rate K concentration in the fruits of date palm variety B3 inoculated with C2 pollen amounted to 1.21% compared to the lowest rate amount of K in the fruits of date palm varieties B2 and B1 was 1.01% and 0.98%, respectively, the results indicate that the highest rate K concentration in B2 palm fruits inoculated with C3 pollen was 1.92%, while the lowest K concentration in B1 and B3 palm fruits was 1.07%. The reason for this may be due to the vitality of pollen grains and the percentage of germination, and these results are correspond with the results obtained by Mohamed *et al.* (2016).

**Table 3. Effect of male and female cultivars in potassium (K) % concentration of fruits.**

morale level	Male cultivars				Female cultivars
	(C4)	(C3)	(C2)	(C1)	
N.S	A	B	B	AB	(B1)
	1.03 ±0.074	1.07±0.016	0.98± 0.012	1.01±0.051	
	a	A	a	a	
0.0001	A	A	B	B	(B2)
	0.94 ±0.071	1.92±0.042	1.01±0.013	0.94 ±0.052	
	b	A	b	b	
N.S	A	B	A	A	(B3)
	1.14±0.035	1.07±0.023	1.21±0.053	1.16 ±0.040	
	a	A	a	a	
	N.S	0.0001	0.0052	0.043	morale level

Values mean rate ± stander error.

N.S.: It means that there are no significant differences between the rates of the transactions at the morale level ( $P \leq 0.05$ ).

a, b, c: the different lowercase letters within the same row indicate the presence of significant differences between the male varieties, while the different capital letters within the same column indicate the presence of significant differences between the female varieties within the same male variety at the morale level ( $P \leq 0.05$ ).

**Iron (Fe) concentration rate in date palm fruits:** Table 4 shows that there is a significant difference ( $P \leq 0.05$ ), as the highest rate of Fe concentration was recorded in B1 palm fruits inoculated with C3 pollen, which amounted to 66.2 ppm, while the lowest rate of Fe concentration was in palm fruits inoculated with C1, C4 and C2 pollen grains, which amounted to 63.7 ppm. 63.5, ppm 63.2 respectively, the results indicate that the highest rate of Fe concentration was recorded in B2 palm fruits inoculated with C3 pollen amounted to 62.7 ppm compared to the lowest rate of Fe concentration in palm fruits inoculated with C1 pollen amounted to 27.5 ppm, the results showed that the highest rate of Fe concentration in palm fruits B3 inoculated with C3 pollen amounted to 66.2 ppm compared to the lowest rate of Fe concentration in palm fruits inoculated with C2 and C4 pollen grains reached 59.0 ppm, 58.7 ppm respectively.

**Table 4. Effect of male and female cultivars In Iron (Fe) ppm concentration of fruits.**

morale level	Malecultivars				Female cultivars
	(C4)	(C3)	(C2)	(C1)	
0.0002	A	A	A	A	(B1)
	63.7±0.190	66.2±0.277	63.2±0.219	63.5±0.357	
	b	a	B	b	
0.0001	C	B	C	C	(B2)
	53.7±0.069	62.7±0.080	53.0±0.404	27.5±0.277	
	b	a	B	c	
0.0001	B	A	B	B	(B3)
	58.7±0.190	66.2±0.334	59.0±0.178	61.0±0.225	
	c	a	C	b	
	0.0001	0.0001	0.0001	0.0001	morale level

Values mean rate ± stander error.

N.S.: It means that there are no significant differences between the rates of the transactions at the morale level ( $P \leq 0.05$ ).

a, b, c: the different lowercase letters within the same row indicate the presence of significant differences between the male varieties, while the different capital letters within the same column indicate the presence of significant differences between the female varieties within the same male variety at the morale level ( $P \leq 0.05$ ).

Table 4 also showed the overlap of the rate Fe concentration in the fruits of palm cultivars inoculated with pollen, to the presence of significant differences ( $P \leq 0.05$ ), as the concentration of Fe was significantly superior in the fruits of the B1 palm variety inoculated with C1 pollen, and the highest value was recorded at 63.5 ppm compared to the concentration of Fe for palm fruits. B2, which recorded the lowest value, was 27.5 ppm, the results indicated that the concentration of Fe was significantly superior in the fruits of the date palm variety B1 inoculated with pollen C2 and recorded the highest value of 63.2 ppm compared to the rate concentration of Fe in the fruits of the date palm variety B2 which recorded the lowest value of 53.0 ppm, the results showed that the highest rate of Fe concentration in the fruits of date palm varieties B1 and B3 inoculated with C3 pollen





was 66.2 ppm, while the lowest rate of Fe concentration in the fruits of date palm B2 was 62.7 ppm, the results showed that the highest rate of Fe concentration in B1 palm fruits inoculated with C4 pollen was 63.7 ppm compared to the lowest rate of Fe concentration in B2 palm fruits inoculated with 53.7 ppm. The reason may be due to the high ability of some male cultivars to absorb large quantities of the element from the soil due to the different susceptibility of roots to absorption and the extent of their spread in the soil of different cultivars (Karthika et al., 2018).

**Sodium (Na) concentration rate in date palm fruits:** The results of Table 5 showed that there were significant differences ( $P \leq 0.05$ ), as the highest concentration of Na was recorded in B2 palm fruits inoculated with C4 pollen, reaching 7.0 ppm, while the lowest rate Na concentration was in palm fruits inoculated with C1 pollen, reaching 5.0 ppm, the results showed that the highest rate of Na concentration in date palm fruits of variety B3 inoculated with C2 pollen amounted to 8.03 ppm compared to the lowest rate of Na concentration in palm fruits inoculated with C1 and C4 pollen, which amounted to 5.50 ppm. The results also indicated that there were significant differences ( $P \leq 0.05$ ) for the overlap in the rate concentration of Na in the fruits of the cultivars.

**Table 5. Effect of male and female cultivars In Sodium (Na) ppm concentration of fruits.**

morale level	Malecultivars				Female cultivars
	(C4)	(C3)	(C2)	(C1)	
0.0002	A 7.0±0.265	AB 6.5±0.121	AB 7.0±0.346	A 7.2±0.346	(B1)
0.0001	A 7.0±0.190	B 6.0±0.30	B 6.0±0.415	B 5.0±0.196	(B2)
0.0001	B 5.50±0.190	A 7.0±0.109	A 8.03±0.093	B 0.132±5.50	(B3)
	C 0.0016	b 0.011	A 0.032	c 0.0041	morale level

Values mean rate ± stander error. .

N.S.: It means that there are no significant differences between the rates of the transactions at the morale level ( $P \leq 0.05$ ).

a, b, c: the different lowercase letters within the same row indicate the presence of significant differences between the male varieties, while the different capital letters within the same column indicate the presence of significant differences between the female varieties within the same male variety at the morale level ( $P \leq 0.05$ ).

The highest rate of the concentration of Na was recorded in the fruits of the date palm variety B1 inoculated with C1 pollen grains, amounting to 7.2 ppm as for the rate concentration of Na in the fruits of the cultivars B3 and B2, it recorded less Values of 5.50 ppm and 5.0 ppm respectively, the results showed that the highest rate of Na concentration in the fruits of date palm variety B3 inoculated with C2 pollen

was 8.03 ppm compared to the rate concentration of Na in the fruits of date palm variety B2 which recorded the lowest value of 6.0 ppm, the results shown in Table 5 indicate that the highest rate concentration of Na in the fruits of date palm variety B3 inoculated with C3 pollen was 7.0 ppm compared to the lowest rate concentration of Na in the fruits of date palm variety B2 which was 6.0 ppm, the results showed that the sodium concentration was significantly higher in palm fruits of cultivars B1 and B2 inoculated with C4 pollen, and recorded the highest value of 7.0 ppm while the lowest rate concentration of Na in palm fruits of cultivar B3 inoculated with C4 pollen was 5.50 ppm. The reason for recording significant differences in the concentration of sodium in the fruits of palm cultivars may be due to its effect on the concentration of elements in pollen of different stallions (Khan et al., 2022), and thus the effect of this on the amount of the element in the fruits these results are inconsistent with Parvin et al. (2015).

**Conclusion:** From the analysis of the results obtained from this study, it was known the effect of pollen grains (C1, C2, C3, and C4) on the level of elements (Cu, Zn, K, Fe and Na) in the fruits of date palms of varieties (B1, B2 and B3), the results showed that the highest concentration of Cu was in the palm fruits of the B2 variety inoculated with C1 pollen, and the highest concentration of Cu overlap was recorded in the fruits of the B3 variety inoculated with C1, C2, C3 and C4, the highest Zn concentration was recorded for B1 palm fruits inoculated with C3 and C4 pollen, and the highest Zn concentration was in B3 palm fruits inoculated with C1 and C4 pollen, the highest concentration of Zn interference was in B3 palm fruits inoculated with C1 pollen, the highest interference overlap of Zn was in B2 palm fruits inoculated with C2 pollen, and the highest concentration of Zn was in B1 and B2 palm fruits inoculated with C3 pollen, The results showed the highest K concentration was in the fruits of the B2 variety inoculated with C3 pollen, and the highest concentration of K interference was in the fruits of the B3 date palm inoculated with C1 pollen, the highest concentration of K overlap was in the fruits of variety B3 inoculated with C2 pollen the highest concentration of overlap K was in the fruits of variety B2 inoculated with C3 pollen, The results showed the highest concentration of Fe was in the fruits of palm B1, B2 and B3 inoculated with C3 pollen, The highest concentration of Fe overlap was recorded in B1 palm fruits inoculated with Stallion pollen used in the study, the highest concentration of Fe overlap was recorded in fruits inoculated with C3 pollen, The results of the experiment showed that the highest concentration of Na was in B2 and B3 palm fruits inoculated with C4 and C2 pollen respectively, the highest concentration of Na overlap was recorded in B1 fruits inoculated with C1 and C4 pollen grains. The highest concentration in fruits of B2 variety was in C4



pollen grains, and the highest concentration of Na overlap in fruits of B3 class was in C3 and C2 pollen.

**Authors' Contribution:** all of three authors (Uday Hatem Khaer Abed\*, Qusay Ahmed Olaij and Saddam Hussein Ali) are closely involved in all of process of present study, from designing, analysis, to writing.

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